



CSIR NEWS

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Pilot Plant for Furfural Installed at RRL, Jorhat

A 25 kg/day scaled-up unit for production of furfural from bagasse was inaugurated at the Regional Research Laboratory (RRL), Jorhat, by Dr G. Thyagarajan, Director of the laboratory, on 9 September 1977. Earlier, the work was carried out and optimized in a 5 kg/day unit.

Furfural is a very important chemical used for refining petroleum fractions such as lube oil, making resins of phenol-furfural type and as a decolorizing agent for wood resins, as a resin solvent and wetting agent in the manufacture of abrasion and brake linings, in extractive distillation of butadiene and other C_4 hydrocarbons. It is also used in the manufacture of furan and tetrahydrofuran compounds and some drug intermediates.

Current requirement of furfural in the country is estimated at about 1500 tonnes/annum and practically the entire quantity is imported. Owing to non-availability of furfural, furan-based industries could not be developed in the country although there is plenty of scope for producing furfural indigenously.

Furfural is produced mainly from the pentosan-rich agro-industrial wastes like bagasse and corn cobs, and the conventional process for making furfural is by pressure digestion of these materials in the presence of acid. The major part of the cost of furfural is due to that of steam necessary for the process. The process developed at RRL, Jorhat, for making furfural from agro-industrial wastes, operates at

normal pressure. Concentration of furfural obtained is also high, thereby reducing the steam consumption considerably and leading to reduction in the cost of production. As furfural is produced from bagasse, which is at present used as a fuel in the sugar industries, an alternative fuel is to be provided to the sugar industries. This will compensate to a very great extent as the cost of furfural is much higher compared to that of sugar. The novelty of the process developed at RRL, Jorhat, is that spent bagasse can be used as a fuel for the process and no extra fuel like coal, oil or gas is necessary.

A number of parties from several sugar-producing states have shown interest in this project. After completion of the scaled-up work, the process will be released to industries for commercial utilization.

Cultivation of Medicinal and Essential Oil Bearing Plants

The Regional Research Laboratory (RRL), Jorhat, has launched a collaborative programme with the Department of Forests, Government of Tripura, for cultivation of medicinal and essential oil bearing plants at Sepahijala, near Agartala. The main emphasis is on diosgenin-yielding species of *Dioscorea*, particularly *D. floribunda*. About 500 plants have already been raised, using tuber pieces and also by ground-layering, the technique having been successfully tried for the propagation of *Dioscorea* at Jorhat. The present programme is intended to rapidly multiply and build up sufficiently large

quantities of planting materials and then to link up the promotional activities with the scheme on 'Jhumia Rehabilitation' taken up by the Department of Forests.

This is yet another step taken up by this regional laboratory towards the development and socio-economic betterment of the industrially backward areas of the north-eastern region through the application of science and technology. The extension of cultivation of these industrially important crops and the establishment of phytochemical industry would profitably utilize the abundantly available 'tilla' land, considered unsuitable for raising traditional food crops, and would supplement the income of the growers. The superior clone(s) of *D. floribunda* evolved and technical know-how developed at the laboratory are proposed to be made available with suitable modifications. The tubers of *Dioscorea* may either be sold as such to drug companies or extracted for recovering diosgenin, the starting material for the manufacture of steroid hormones, including oral contraceptives.

New Electronic Devices Developed at CEERI

The Central Electronics Engineering Research Institute (CEERI), Pilani, has developed a number of new products, e.g. digital sound level meter, electret throat microphone, piezoelectric ceramic throat microphone, VHF multichannel varicap TV tuner, VHF television sweep generator, and RF induction furnace. A brief description of these products is given below:

31 AUG

C.E.T.R.I., MYSORE



Digital sound level meter developed at CEERI, Pilani

Digital Sound Level Meter

This instrument is designed to measure sound pressure levels in decibels with reference to a standard pressure of $0.0002 \text{ dynes/cm}^2$ corresponding to the threshold of hearing of human beings at 1000 Hz. It consists essentially of a calibrated microphone, an amplifier, attenuator network, weighing network and an indicating meter. The digital display used in the sound level meter eliminates the need for an indicating meter and meets the standards laid down by the Indian Standards Institution. These standards are not being met by any manufacturer of such meters at present. All the components used in the meter are available indigenously.

Sound level meters are generally used in the measurement of noise levels in industry, auditoria and other public places, sound level field surveys, and measurements on hi-fi systems.

Electret Throat Microphone

The microphone is in the form of a transducer which reproduces speech by picking up the vibrations directly from the throat. The microphone is actuated by direct contact of the diaphragm

with the throat. It is insensitive to noise or sound coupled acoustically into the microphone. It is sensitive only to vibrations coupled to the diaphragm by direct contact with the portion of the skin excited by the user's voice. The microphone does not pick up acoustic noise and sounds present in the air. Hence it can be used in extremely noisy environments and satisfactory communications can be established and maintained. It leaves the speaker's hands free for other work. The microphone gives good signal to noise ratio over a large part of the audio frequency with good intelligibility.

The pickup of intelligible speech sounds from anatomical vibration is not limited to one location, although it is advantageous to place it at the throat in view of the ease of positioning and fixing of the microphone.

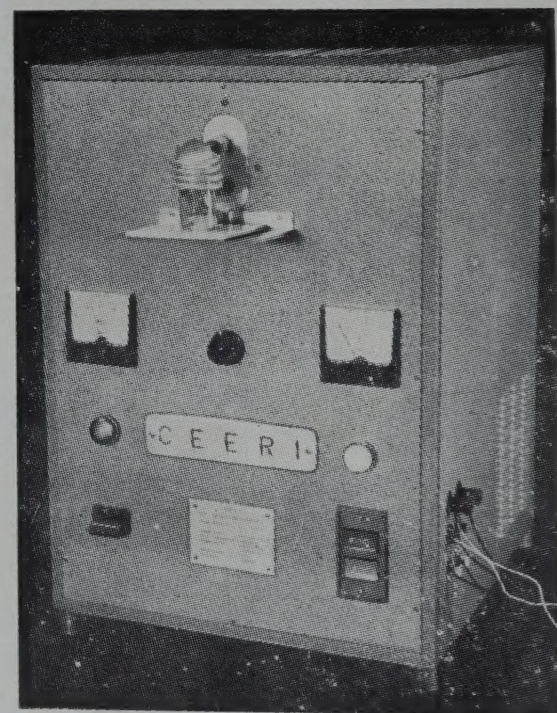
Since the size and shape of the microphone are very small and it does not require any dc bias voltages, it has very wide application: in manpack communication sets for the police, military and paramilitary forces who operate in conditions where both hands have to be free to use weapons; for

communication by drivers, commanders, and operators in trucks, etc. where the ambient noise level is too high. They can also be used by motorcycle riders.

RF Induction Furnace

Main applications of the 1.2 kW RF induction furnace developed at CEERI are heat treatment and annealing, high-temperature brazing, melting in controlled atmosphere, soldering of electronic components, glass-to-glass sealing, etc. This low-power, high-frequency unit is specially suitable for heat treatment of very thin and precise jobs. It can be used in the carbon sulphur determinator apparatus, and as a combustion furnace which can burn off most of the samples (metals and non-metals) completely in a very short time. Besides, it can be a general-purpose RF power source for plasma systems and other scientific experiments.

The furnace developed at CEERI is fully indigenous, does not require water or forced air cooling, and has grid tap switch for load matching, connections for variac (optional) or any other power control device, and space and connections for timer (optional).

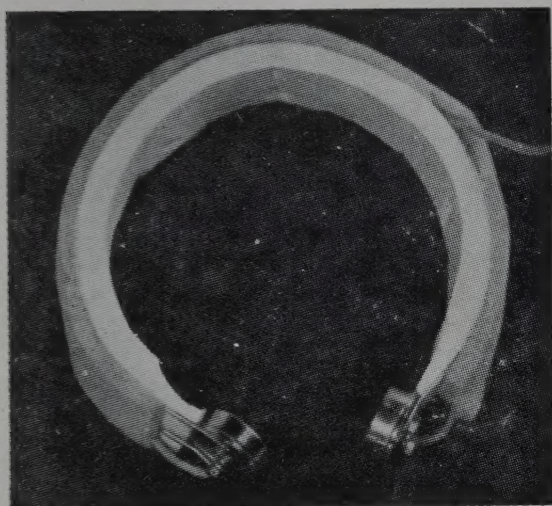


RF Induction furnace developed at CEERI, Pilani

Its operation is fast and it is fully safe to the operating and servicing personnel. RF radiation and line interference meet the international standards.

Piezoelectric Ceramic Throat Microphone

This microphone makes use of the basic know-how of vibration pickups, earlier developed by the institute and released to industry for commercial exploitation through the National Research Development Corporation of India. It utilizes piezoelectric ceramic materials which are not affected by humidity and temperature.



Piezoelectric ceramic throat microphone :
CEERI, Pilani

The microphone nullifies the effect of environmental noise in recording or transmitting any message in a noisy environment. It is expected to be useful for bus drivers, pilots, sea divers, radio commentators and traffic policemen. Indirectly, it can be used as a bugging device.

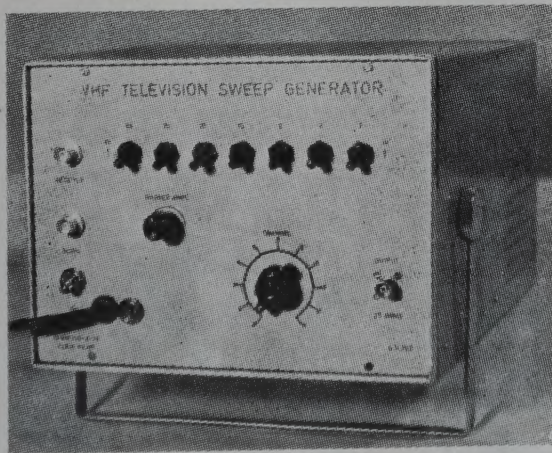
VHF Multichannel Varicap TV Tuner

The development of this tuner is a part of the efforts being made at CEERI with a view to achieving maximum indigenization of TV receiver know-how while keeping abreast of the latest technology in the field. The tuner uses varactors for tuning the channels and switching diodes for switching between the bands I and III. Both the devices operate on the command of a dc signal and therefore the normal wear and

tear to which the turret type or push button type tuners are subjected is totally absent, giving long life and good reliability. All the coils used in the RF amplifier and the oscillator are fixed and do not normally require adjustments so that they can be permanently locked for reliable operation. The band I coils are coupled through a mutual coupling coil while those of band III are air-coupled by being wound on the same former. This kind of scheme affords considerable flexibility for optimizing the gain, bandwidth and tracking especially in band III. The transistor BF-182 used in the mixer stage has a gradual fT fall-off and gives good conversion, gain, noise figure and potential stability. The double-tuned coupled circuit (using capacitive transformation) used at the collector of mixer further helps in suppressing spurious oscillations that otherwise can occur from magnetic coupling. The tuner is reliable and compact.

VHF Television Sweep Generator

The sweep generator designed and developed at CEERI is a transistorized portable generator suitable for use in the manufacturing and servicing of TV sets. This generator has 11 preset channel selectors covering the TV frequency range. The channel output voltage-flatness remains practically constant over the swept frequency range of each channel. The output voltage level is varied by means of toggle switch attenuators developed



VHF television sweep generator developed
at CEERI, Pilani

especially for this generator. Crystal-controlled pulse-type leading edge sound and vision markers are provided for all the channels. Moreover, IF channel has two extra markers.

Isatoic Anhydride from Phthalimide

Isatoic anhydride, 2H-3,1-benzoxazin-2,4-dione, is a versatile and very reactive organic intermediate not introduced in the Indian chemical industry so far. In an effort to introduce this relatively new organic intermediate in India, a process has been developed for its manufacture at the Regional Research Laboratory (RRL), Bhubaneswar.

There is a wide scope for development of isatoic anhydride as a bulk chemical since it is useful in the introduction of anthranilyl moiety for the manufacture of a great variety of industrial chemicals. Products of superior quality can be obtained by simpler and fewer operations in better yields from isatoic anhydride than from the other conventional starting materials.

Isatoic anhydride finds use in the manufacture of flavours and fragrances like methyl, ethyl and N-methyl methyl anthranilates of the agrochemical intermediate 4-keto-benzotriazine; and pharmaceuticals like methaqualone, *o*-aminobenzophenones, and saccharin. The sulpho-, chloro- and nitro-derivatives of this intermediate find application in the dye industry. Isatoic anhydride itself is used as a deodouring agent for mercaptans, amines and alcohols. Isatoic anhydride and 4-ketobenzotriazine find application as blowing agents in the manufacture of polymer foams.

The process developed at RRL consists in the oxidation of phthalimide with chlorine or hypochlorite and utilizes indigenously available raw materials and equipment.

Studies made on a 4 kg product per batch scale show that the economics of a 10-tonne/annum plant are as follows: total capital investment,

31 AUG 1978

Rs 2.85 lakh (including cost of equipment, Rs 1.00 lakh); manufacturing cost, Rs 2.60 lakh (including cost of raw materials, Rs 1.95 lakh); and return on investment, 14-15%.

Methyl and Ethyl Anthranilates

Methyl and ethyl anthranilates are important perfumery chemicals. Methyl anthranilate, which is reported to occur in several flowers and leaves, is used widely but sparingly in floral composition such as orange blossom and jasmine, particularly for soap and agarbathi industries. It is also used in artificial grape flavours. Ethyl anthranilate finds use in floral compositions for agarbathi and in tea flavouring. Methyl anthranilate is being produced in India by some small manufacturers, but the demand is not being completely met. Ethyl anthranilate is not known to be manufactured in India.

It is estimated that about 20 tonnes of methyl ester and 1-2 tonnes of ethyl ester would be required annually. During 1974-75 and 1975-76 about 13 tonnes/annum of methyl anthranilate were imported.

The Regional Research Laboratory (RRL), Bhubaneswar, has developed a single-step process which can produce alkyl anthranilates of very high purity conforming to standard specifications, starting from isatoic anhydride. The methyl ester is obtained in 80-85% yield, whereas the yield of ethyl anthranilate is 70-75%.

With a total capital investment of Rs 1.85 lakh, a unit producing 3.75 tonnes of methyl anthranilate and 0.7 tonne of ethyl ester per annum can make a net profit of Rs 39,000, which amounts to 21% of invested capital.

The process has been assigned to the National Research Development Corporation of India for commercial exploitation.

Methaqualone and Methaqualone Hydrochloride

Methaqualone is an accepted non-barbiturate sedative already in chemical practice. Standard Pharmaceuti-

cals Ltd, Calcutta; Boots Pure Drug Co., Bombay; Roussel Laboratories, Bombay; and Sarabhai Chemicals, Baroda, are the important formulators of this drug. Methaqualone and its hydrochloride are produced in India by Dipak Laboratories, Calcutta, and Vazir Alli Pvt. Ltd, Bombay. It is estimated that the drug may be needed to the tune of 20 tonnes/annum in 1978-79. No import of this drug is reported.

The Regional Research Laboratory (RRL), Bhubaneswar, has developed an improved method for the manufacture of this drug. The advantages of this method are that no dehydrating agent like phosphorous oxychloride is used, and the yields are higher.

Through this process methaqualone can be manufactured from anthranilic acid or isatoic anhydride. The raw material is reacted with acetic anhydride and the acetylated product is isolated. The acetylated material is then refluxed in a hydrocarbon solvent with *o*-toluidine under suitable conditions when methaqualone is formed. From the reaction mixture the compound is isolated as its hydrochloride, which is purified by crystallization. The free base is obtained in 57% [stoichiometric or 100% with respect to isatoic anhydride and 119% with respect to anthranilic acid (w/w basis)].

Studies made on 1 kg/batch scale indicate that on a plant producing 1 tonne of this chemical per annum with a selling price of Rs 200/kg, the profitability (after taxes) would be 40%.

The raw materials and equipment needed are indigenously available.

The process has been referred to the National Research Development Corporation of India for commercial exploitation.

Potential Antifertility Agents

In the female reproductive system, a proper synchronization of events starting from ovulation to parturition is mainly maintained by a critical balance of estrogen/progesterone, which when hampered at any stage leads to the termination of pregnancy. The use of 'atypical' estrogens, particularly during

the susceptible post-ovulatory period, may cause hormonal imbalance and thus can lead to effective contraception. In a project undertaken by Shri P. L. Kole of the Central Drug Research Institute, Lucknow, under the guidance of Dr Nitya Nand, Director of the institute, three different classes of compounds which might act as 'atypical' estrogens were designed, synthesized and screened for antifertility activity.

9,11-Secoestradiol and its derivatives were synthesized with a view to reducing the estrogenicity of the parent molecule by making them more flexible and thereby reducing the conformational requirements toward estrogen receptor activation, but without loss of their antifertility activity. However, compounds with reduced estrogenicity were found to be less active antifertility agents.

Erythro- and *threo*-2, 3, 3-triarylpropanols resembling the structures of known antifertility agents MER-25 and centchroman were found to be either inactive or weakly active as anti-implantation agents.

Promising antifertility activity has been shown by 2, 3-*cis*-3, 4-*cis* and 2, 3-*trans*-3, 4-*trans*-2-methyl-3-phenyl-4-[4-(2-pyrrolidinoethoxy) phenyl]-7-methoxychromans. These compounds have been found to be 100% active at 2 mg/kg and are under further evaluation.

Shri Kole has been awarded the Ph. D. degree of the University of Lucknow for his thesis based on these investigations.

Report on Comparative Evaluation of Additives: RRL, Jorhat

At the instance of the Union Ministry of Petroleum & Chemicals, the Regional Research Laboratory (RRL), Jorhat, studied the pipeline transportation problems of waxy crudes of the Oil & Natural Gas Commission (ONGC) both from the eastern region and the Bombay High. The eastern crudes and the Bombay High crudes were studied and a report titled 'Comparative evaluation of additives for

transportation of waxy crudes of India' was prepared and submitted to the Ministry.

Science and Society— Orientation Programme

A ten-day Orientation Programme on Science and Society was conducted by the Management Development Unit of the Planning Division, Council of Scientific & Industrial Research, at the National Aeronautical Laboratory (NAL), Bangalore, from 24 Oct. to 2 Nov. 1977. The programme was inaugurated by Smt. Renuka Devi Barkataki, Union Minister of State for Education and Social Welfare. Thirty eight principals of kendriya vidyalayas (central schools) from different parts of the country participated in the programme in which 28 faculty members consisting of eminent scientists, technologists, educationists, historians of science, and economists presented lectures and led the discussions.

The main objective of the programme was to make the participants appreciate the values of scientific thinking and rationalism and the inviolability of the methods of science so that these concepts permeate in their attitude towards the society, economy and other facets. The methodology followed in this programme was to expose the participants through the history and sociology of scientific thought and the achievements of science and technology with special reference to the post-independence period in India.

Lectures delivered were on the impact of science and technology on society and *viceversa*; history of scientific thought both in national and international scene; national freedom movement, highlighting the impact of Swadeshi spirit on the growth of indigenous technology; organization, policy planning and management of science in India; application of the methods of science and development of scientific attitude to combat superstitions and other social ills; future of science and technology in India, and discussion

on technologies relevant to Indian conditions; role and prospects of science education; and the building up of suitable educational models and management practices for schools.

Discussions were held on issues like factors which inhibited industrial revolution in India while the same changed the civilization in Europe and America; problems of identification of the colonial legacies obtaining in the present-day Indian education and culture, science and social institutions; important role of scientific methods and values in regenerating social structure and functions; importance of inculcating scientific methods and values in the minds of students so that they can act as agents of social change; and the conflict between the existing value system and the value system of the society that is yet to be born.

Visits to some factories in and around Bangalore and the Visvesvaraya Industrial & Technological Museum as well as to Mysore were also organized as part of the programme.

Deputation Briefs

Prof. Dinesh Mohan, Director, Central Building Research Institute (CBRI), Roorkee, visited Bangkok on invitation from the Applied Sciences Research Corporation of Thailand (ASRCT). During his visit, from 26 June to 5 July 1977, Prof. Dinesh Mohan held discussions on cooperation in research between the two countries with the Governor Dr Wadanyu Nathalang and the Deputy Governor Dr Smith Kampempool. He also visited the following laboratories of ASRCT: Building Research Department, Environmental and Ecological Research Department, Testing and Standards Department, and the Thai National Documentation Centre.

On invitation from Mr Vickery, Senior Architect of Unesco Office for Education in Asia in Bangkok, Prof. Dinesh Mohan held discussions relating to CBRI programmes on the construction of economical and efficient school buildings.

Prof. Dinesh Mohan also witnessed the manufacture of bricks and building on a cottage industry scale.

Prof. Dinesh Mohan found that the research work being carried out in the various laboratories of ASRCT had many areas in common with the work being done at the corresponding national laboratories of CSIR. Hence exchange of visits between the scientists concerned and exchange of relevant publications would be of great mutual advantage. Dr Nathalang and Dr Kampempool expressed keenness for such exchanges and are expected to sign a general agreement for scientific cooperation between ASRCT and CSIR.

PROGRESS REPORTS

RRL, Hyderabad, Report: 1975 & 1976

The Regional Research Laboratory (RRL), Hyderabad, has brought out its report which covers the R&D activities of the laboratory for the years 1975 and 1976. The development of a viable design and engineering group, intensive collaborative work on pesticides and intermediates, increased quantum of sponsored work from industry, rescheduling of R&D programmes with special orientation towards priority activities, and the decision to establish a semi-autonomous Centre for Cellular and Molecular Biology at RRL in 1977 are some of highlights of the report. Fourteen processes developed by the laboratory were released for commercial exploitation. Twenty-three new sponsored projects were taken up. Seventeen sponsored projects were completed. Thirty-six reports relating to know-how, design and engineering and other matters were prepared.

An extended basic design of tar distillation section of the low temperature carbonization plant (capacity, 2700 tonnes coal/day) was submitted to Engineering Projects India Ltd, New Delhi. A basic design report on the plant was earlier submitted to the firm. The process know-how and

designs for the effluent treatment plant, based on the data generated at this laboratory, were prepared by the National Environmental Engineering Research Institute, Nagpur. New char-briquetting composition and techniques have also been developed to provide a more profitable outlet for byproduct char fines.

The commercial plant for the production of silicon carbide (capacity, 600 tonnes/annum) was commissioned and operated. Besides black silicon carbide, the green variety was produced in trial runs.

The report on the basic design for a cyclohexane pilot plant (capacity, 1 tonne/day) was submitted to the Gujarat State Fertilizers Co. Ltd (GSFC), Baroda. The erection of pilot plant at Baroda and the preparation of the catalyst (200 kg) at RRL were in progress. GSFC and RRL are jointly developing the know-how and designs for a commercial plant to manufacture cyclohexane.

Double-blind clinical trials on an N-aralkyl anthranilic acid derivative (RH-8), which had shown promising anti-inflammatory/antirheumatic activity, have been completed.

The development of technology for the manufacture of pesticides was placed on inter-laboratory collaborative programme. The priorities and time targets were fixed in consultation with the concerned ministries. The programme relating to the manufacture of pesticides also included the development of know-how for the manufacture of key intermediates and some basic raw materials like phosgene and phosgene-based chemicals, *p*-chlorophenol, 2, 4-dichlorophenol, *m*-chloroaniline, allyl chloride, diketene and diketene-based chemicals and trimethyl phosphite. Notable amongst other intermediates on which work was in progress are epichlorohydrin, glyoxal, phthalic anhydride, vinyl acetate and pentaerythritol.

A modified procedure was worked out for the production of hydrogenated castor oil (HCO) which permits improvement in the quality of the pro-

duction and reduction in cost. Conditions were standardized to obtain mixed fatty acids which along with HCO have considerable demand abroad. A new procedure was evolved for simultaneous splitting and dehydration of castor oil to give light coloured dehydrated castor oil (DCO) fatty acids in a one-step reaction (yield, 70% monomer; conjugation, 30-50%). DCO fatty acids are valued in the manufacture of high quality surface coatings. Their dimers find application in surface coatings and in the manufacture of polyamide resins.

The laboratory supplied designs of the critical units of a plant to manufacture active carbon from saw dust by fluidized-bed technique being set up at Manila (Philippines). The plant (capacity, 600 tonnes/annum) was likely to be commissioned soon under the supervision of RRL scientists. Another plant for manufacturing adsorbent-grade active carbon at Hyderabad was also expected to go into the production soon. Special design features have been incorporated in the conventional rotary kiln for the manufacture of steam-activated carbons.

A new protein, seminal plasmin, has been isolated from bovine seminal plasma; it inhibits the growth of *Esch. coli* and several other microorganisms.

BITM Annual Report : 1976

The Birla Industrial and Technological Museum (BITM), Calcutta, has brought out its annual report for 1976. The report shows that a significant contribution was made towards popularization of science and technology by introducing two new sets of exhibits, namely 'The Science of Motion' and 'Mathematics through Fun' in the mobile exhibition units. Steps were taken for starting 'Nehru Science Centre' at Bombay, as an institutional project of this museum.

During the period under review the existing 11 galleries of the museum, viz. Nuclear Physics, Motive Power,

Transport, Popular Science, Mining, Copper, Iron & Steel, Petroleum, Electricity, Electronics & Television, and Communication, were visited by about 2.35 lakh persons. One thousand six hundred and sixty organized groups covering more than 56,000 students, teachers and scholars from different schools, technical institutes, colleges and universities undertook study tour to this museum.

As many as 380 films on scientific and technical subjects were screened in the museum auditorium, and nearly 78,000 people, mostly students, attended the film shows. Five hundred sixty-nine such film shows were also held in rural areas through the regional science centres and mobile science exhibition units.

As in the previous years, the various educational activities organized by BITM to popularize science education and to create scientific temper among the masses included : mobile science exhibition for rural and urban areas; experimental regional science centre for sustained educational programmes in selected areas; science demonstration lecture for school students; creative abilities centre to develop creative talent among the young students; students' science seminar; teachers' training programme; science fair camp; film show; popular lecture; sky observation programme; television show; and science quiz contest.

The museum rendered technical assistance and guidance to other museums and scientific and cultural institutions in the planning and setting up of their galleries, exhibitions, workshops, science hobby centres, and in the fabrication of models and exhibits.

Six mobile science exhibition units covering transformation of energy; light and sight; the planet we live in; the science of motion; mathematics through fun; and popular unit (temporary exhibition) toured different places in West Bengal, Bihar, Orissa, Assam, Uttar Pradesh, Delhi and Tripura. Mobile science exhibitions were held in 192 places, and about

7,80,000 people visited such exhibitions.

A science camp (Eastern India Science Camp) was held in BITM from 28 February to 7 March 1976. This was organized in collaboration with the education directorates of different state governments of Eastern India. Prior to the science camp, 5 regional science fairs were organized at Purulia, Malda, Midnapore, Jalpaiguri and Baidyapur (Burdwan) during February 1976.

A feature of the 17th anniversary of BITM held during May 1976 was a 15-day training programme—self-employment scheme for rural youths in ceramic technology, fruit and lac processing, leather technology and paper-making.

One hundred and sixty-nine science demonstration lectures were delivered to more than 20,000 students and teachers in Calcutta and in rural schools on eight different scientific subjects.

Twenty popular lectures on different branches of science by eminent scholars were organized.

All Bengal and interstate students' science seminars on the topic 'In Quest of New Energy Sources' were held at BITM on 22 September 1976.

A teachers' training programme was organized with a view to imparting training to the school teachers so as to enable them to run creative abilities centres in their own schools. Seventy science teachers representing 42 schools were trained during the year.

BITM also participated in the National Science Exhibition for Children (New Delhi) and Nehru Fair (Calcutta). BITM, in collaboration with the University of Calcutta and the Indian Association for the Cultivation of Science, Calcutta, celebrated the 1500th birth anniversary of Aryabhata-1 on 22 December 1976. The programme included, among other things, a seminar on Aryabhata's contribution.

Characterizing the flow, identifying the various flow zones and suggesting an appropriate model to describe the axial mixing phenomenon. These studies covered flow situations under both stationary rotor and finite rotor speeds.

The study consisted of deriving partial differential equations of continuity and momentum in two dimensions to suit the axi-symmetrical nature of the column. Appropriate boundary conditions were also derived. A solution scheme was proposed and successfully applied to the problem of RDC, covering different rotor speed situations. Contour plots of stream function distribution have revealed the characteristics of various flow regions. This has helped in constructing a new model which was found more realistic to describe the axial mixing phenomenon. Further, this model offers possibilities of development to yield a method to predict axial mixing coefficients theoretically and without the use of experimental residence time distribution studies.

CSIR SUPPORT TO RESEARCH

Completed Schemes

Axial Mixing in Rotary Disk Contactors

Rotary disk contactors (RDC) are widely used in petroleum and petrochemical industry in operations involving furfural and sulphur dioxide extraction, propane deasphalting, sulfolane extraction, caprolactam purification and dewaxing of lube oils. It is recognized that axial dispersion in the contacting liquid phases lowers the effective rate of mass transfer in continuous counter-current solvent extraction columns. While it is almost impossible to suppress fully the axial mixing in RDC, it would be necessary to know the magnitude of this effect in order to facilitate scale-up and design. For accurate design of RDC equipment, a knowledge of the non-ideal flow behaviour of continuous phase is essential in terms of axial mixing coefficients or Peclet numbers. This has been the subject of investigation by various

workers. However, a sound understanding of this axial mixing phenomenon in terms of flow characteristics is lacking.

Investigations on the axial mixing phenomenon in RDC were carried out at the Alagappa Chettiar College of Technology, Guindy, Madras, by Shri J. Venkataramana (a CSIR research fellow) working under the guidance of Dr G. S. Laddha, director of the institute.

Experimental studies involving measurement of axial mixing coefficients were made and the results analyzed in terms of Peclet numbers in the conventional manner. The experimental axial mixing Peclet numbers were compared with those predicted on the basis of empirical correlations and available in the literature. The comparisons revealed the uncertainties and inadequacy of the various correlations reported. Hence, theoretical studies were made with a view to obtaining flow visualization in the RDC apparatus, i.e. cha-

PERSONNEL NEWS

Appointments/Promotions

Dr T. R. Ingle

Dr T. R. Ingle of the National Chemical Laboratory (NCL), Poona, has been appointed Scientist EI on promotion from Scientist C (24 June 1975).

Dr Ingle (born 8 Sept. 1924) obtained his B. Sc. (Hons) (1945) and M. Sc. (1948) from the Bombay University and Ph. D. (1956) from the Poona University. He was on the staff of Sir Parashurambhau College, Poona, in various capacities from 1945 to 1955 till he joined NCL (1955).

Dr Ingle has carried out research work mainly in the field of carbohydrates. He has worked on the synthesis of thio sugars, mechanism of oxidation of natural polysaccharides, mechanism of glycosidation of phenols, preparation of starch and cellulose derivatives of industrial importance, structural elucidation of gums and mucilages, and utilization of agricultural waste. He has also conducted

synthetic work in the field of peptides and heterocyclic drugs.

Dr Ingle worked as a post-doctoral research fellow at the Purdue University, Indiana, for three years (1962-1965). During his stay in USA, he participated in the 145th meeting of the American Chemical Society held at New York in September 1963.

Dr Ingle has developed processes for manufacture of D-glucosamine hydrochloride, L-arabinose, D-galactose, and CNS gum from industrial wastes. He has worked out new methods for preparation of different glycosides of industrial importance. He has also collaborated in several industrial projects undertaken in NCL.

Dr Ingle has published more than 55 research papers.

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Appointments at the Regional Research Laboratory (RRL), Bhubaneswar, included : Dr S. B. Kanungo (Scientist C; 30 April 1977); Shri S. C. Panda (Scientist C; 2 May 1977); Shri B. M. Sarangi (Scientist B; 12 Jan. 1976); Shri S. Das (Scientist B; 2 Feb. 1976); Shri I. B. Das (Scientist B; 15 March 1977); Dr S. C. Das (Scientist B; 15 March 1977); Shri T. R. Gupta (Scientist B; 15 March 1977); Shri B. C. Jena (Scientist B; 15 March 1977); Shri A. Lakshminarayana (Scientist B; 15 March 1977); Dr V. M. Pandey (Scientist B; 15 March 1977); Dr P. V. R. B. Sarma (Scientist B; 15 March 1977); Shri L. B. Sukla (Scientist B; 15 March 1977); and Shri M. Singh (Documentation Officer; 29 Nov. 1976).

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Consequent on assessment, Shri J. C. Choudhury of RRL, Bhubaneswar, has been promoted as Scientist A (1 Aug. 1975).

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The following have been promoted consequent on five-year assessment at the Central Fuel Research Institute (CFRI), Dhanbad :

As Scientist C

Shri T. Das Gupta (20 July 1974); Shri J.M. Sanyal (3 Jan. 1976); Shri S.G. Tumuluri (15 April 1976); Dr S. K. Chatterjee (13 June 1976); Dr D.M. Bhat (4 July 1976); Shri D.K. Sen (27 July 1976); Shri T.K. Bhowmick (28 July 1976); Shri Samiran Basu (29 July 1976); Shri A.K. Ghosh (2 Aug. 1976); Shri S. Sakha (1 Jan. 1977); Shri J. Chattopadhyay (1 Jan. 1977); Shri K. K. Dutta (1 Jan. 1977); Shri K.K. Kanjilal (1 Jan. 1977); Shri H.K. Guha (1 Jan. 1977); Shri A.K. Mukherjee (1 Jan. 1977); and Shri A.K. Bhadury (1 Jan. 1977).

As Scientist B

Shri R.P. Ghosh (29 Jan. 1976); Shri B.C. Handique (2 Feb. 1976); Shri S. K. Sarkar (14 Feb. 1976); Shri P.R. Roy (12 March 1976); Shri S.K. Chakraborty (12 March 1976); Shri R. B. Paul (13 March 1976); Shri M.B. Roy (23 March 1976); Shri B.B. Brahmachari (23 March 1976); Shri A.N. Sengupta (23 March 1976); Shri Bhubaneswar Das (29 March 1976); Shri K.P. Sharma (1 April 1976); Shri J.K. Shama (30 May 1976); Shri M.C. Roy (8 June 1976); and Shri S.K. Mitra (12 July 1976).

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Consequent on five-year assessment the following personnel of the National Geophysical Research Institute, Hyderabad, have been promoted from Scientist B to Scientist C : Dr P. S. Gogte (3 Jan. 1977); Dr B.K. Rastogi (29 March 1977); and Dr B.S. Sukhija (6 May 1977).

PATENTS SEALED

163/Del/77 : An improvement in the design features of the discharge mechanism of vertical shaft kiln, S.K. Rao, S. N. Dutta & U. Choudhury—RRL, Jorhat.

139136 : A method for isolation of diosgenin from plant materials such as weeds of genera *Kallstroemia* and *Tribulus*, R. N. Chakravarti, S. B.

Mahato, N.P. Sahu & Bikas Chandra Pal—IEM, Calcutta.

Hari Om Ashram Prerit S. S. Bhatnagar Research Award

The Central Salt & Marine Chemicals Research Institute (CSMCRI), Bhavnagar, has invited nominations for the 1976 and 1977 Hari Om Ashram Prerit S.S. Bhatnagar Research Award. The award, instituted by the board of trustees of the Hari Om Ashram, Nadiad, is given every year in rotation to an Indian individual/team for his/her/its outstanding original researches in desalination, solar energy for power, and prevention of water pollution in India.

The award for the year 1976 will be in 'Solar energy for power'. As the nominations received in response to the earlier invitation have been found unsuitable, the expert committee has decided to invite fresh nominations for the 1976 award.

The award for the year 1977 will be in 'Prevention of water pollution in India'.

The value of the award would be Rs 5000 each for the two topics, each to be divided into two cash awards. Only outstanding original research done within five years immediately preceding the grant of the award will be considered.

Nominations (six copies) for each of the topics separately in the prescribed proforma, with relevant documentary evidence for the consideration of the expert committees, should reach the Director, CSMCRI, on or before 1 January 1978. The regulations governing the award and the prescribed application forms can be had from the Planning Cell, Central Salt & Marine Chemicals Research Institute, Bhavnagar 364002, by sending a self-addressed stamped envelope (26.5 cm × 11 cm).